Adaptation in science, through partnerships

Description

This month, we have been looking more closely at adaptation strategies and how the Met Office is working with government, industry and communities, providing actionable science to inform adaptation strategies to prepare for the climate change that is already happening, as well as future climate risk.

The Met Office Hadley Centre is one of the UK's foremost climate change research centres. Our aim is to provide climate science and services to people and organisations, so they can make better decisions to stay safe and thrive.

We do this by building strong partnerships within the wider climate science community.

These partnerships facilitate the sharing of knowledge, skills and capabilities across closely aligned research and development programmes. By forging innovative partnerships outside traditional discipline boundaries, we can develop the evidence required to inform climate solutions and to address the challenges we face in climate science.

A multi-disciplinary approach to inform real-world solutions

This multi-disciplinary approach is required to understand our changing climate, its impacts and how to minimise these risks. Last year, the Met Office Academic Partnership (MOAP) was expanded to involve universities specialising in other sectors including health, technology, artificial intelligence and social sciences.

Last summer saw temperature records being broken across the UK, but there were also multiple heatwave events, bringing disruption and societal impacts to many communities. One of the priorities MOAP will help the Met Office to advance is around heat health.

Increasing frequency and intensity of heat events is something that society will have to adapt to. Scientists at the Met Office are working with MOAP partners specialising in health and social sciences to understand more about the high-temperature impacts on society, including heat stress and mortality, and to find the best ways to avoid the worst impacts.

Professor Dann Mitchell is the joint MOAP chair at Bristol University – a key partner in the delivery of the heat health aspect of MOAP research. He said: "The impacts of higher temperatures on health are numerous and often feedback on each other in negative ways. They range from immediate impacts, such as direct temperature stress on humans, animals, and ecosystems, to longer-term factors such as decreased cognitive health from persistent exposure to decades of hotter nights.

"To calculate the full health burden of increasing heat on society it is important to carry out research blending traditional climate and weather science with different disciplines such as health science, town planning, and social responses to emergencies.

"Blending these strands together and fusing them into new research is one of the reasons why I am so

excited about the momentum and real-world solutions that the academic partnership brings."

You can find out more about our work in this area is helping society and individuals become more resilient to the health impacts of climate change.

Climate science informing climate solutions

Through a strategic partnership with Esri UK, the Met Office has drawn on expertise beyond our own capabilities to widen the sphere of knowledge to generate a more sophisticated societal response to climate change. By integrating different sets of information and data into climate models, aided by the development of more powerful supercomputers, our scientists with specialisms in artificial intelligence and machine learning can, in turn, discover profound new ways of analysing data and improving insights.

Working with Esri UK, the Met Office has improved access to its climate data and other resources with the recent launch of the Met Office Climate Data Portal to allow organisations, to better understand and respond to climate change risks.

Combining the Met Office's latest projections with Esri UK's geospatial tools has greatly extended the reach and value of this data. UK stakeholders can investigate their physical climate risks over the next 50 to 100 years. For example, data on temperature extremes can be used to understand the impacts on transport infrastructure, health and energy demand.

Met Office expertise and authoritative data combined with Esri's geospatial tools enables complex scientific climate projections to be presented in easy-to-use formats. Spatial analysis can be performed at a global, regional or local level enabling location-specific action plans to be developed to enable organisations to prepare for future impact of extreme conditions on their operations, including heatwaves, floods or droughts.

Professor Jason Lowe, Head of Climate Services at the Met Office commented: "Historically, climate science has defined the problem, now it's moving to help with the solution, providing information at a local level which is highly relevant to UK organisations,"

Addressing the pressing demand for evidence to inform adaptation action.

The Met Office is working with wider stakeholders in a research partnership created, funded and run jointly by the UK Foreign, Commonwealth and Development Office (FCDO) and Canada's International Development Research Centre (IDRC), to bridge critical gaps between science and action.

The Intergovernmental Panel on Climate Change's Sixth Assessment Report on Impacts, Adaptation and Vulnerability emphasised the urgent need for adaptation and the critical need for solutions that cut across sectors and systems to address social inequities to enable a more climate-resilient future for everyone. The UK-Canada framework research programme on Climate Adaptation and Resilience, known as CLARE is responding to this challenge getting knowledge and evidence into use to drive socially inclusive, practical and sustainable adaptation action to build resilience to climate change and natural hazards in Africa and Asia-Pacific.

This initiative, primarily funded by UK aid from the UK government along with IDRC, aims to develop new tools and services to support partner governments, communities, and the private sector to use evidence and innovation to drive effective solutions to the climate challenge, whilst building capacity of both those carrying out the research and those using the resulting evidence.

Through long-term commitments and partnerships worldwide, and needs-driven, action-focused research, CLARE links up short-and long-term issues, enabling long-term, sustainable and equitable economic and social development in a changing climate, whilst supporting early action to reduce impacts of climate variability and providing a better understanding of the risks associated with climate.

CLARE includes three core pillars: 'Research', commissioning new substantive action-oriented research; 'Services' providing timely weather and climate services to inform investments and actions by FCDO, UK government and wider stakeholders; and 'Partnerships', supporting strategic alliances on climate science and adaptation such as the Adaptation Research Alliance (ARA) and Climate Risks and Early Warning Systems (CREWS).

The Met Office is the key partner of CLARE 'Services', in providing timely weather and climate services to inform investments and actions, and working with universities in Africa to deliver ground-breaking, action-oriented research.

You can follow our #GetClimateReady campaign across our social media channels to find out more about how Met Office science is supporting organisations with data and information in order to adapt to climate change.

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How the Met Office makes a difference

Description

The UK National Risk Register (NRR), an assessment of the most significant risks facing the country, has been updated by the Government today. Many of the hazards highlighted by the register are related to natural hazards and the Met Office plays an essential role in dealing with many of the issues. These include severe weather, space weather, coastal flooding, drought etc.

Met Office Services Director, Simon Brown, explains the Met Office role when it comes to preparing for and coping with many of these risks.

The Met Office is a Category 2 Responder working closely with Government and resilience community to warn and protect the public playing a pivotal role at times of severe weather and during related emergencies across the UK. It is a key organisation when it comes to both planning for and responding to emergencies and incidents across the country.

In the latest update of the NRR, published today, hazards associated with extreme weather such as storms, droughts, flooding, extreme cold, snow and ice etc. remain a priority, while the impact assessment for heatwaves is being increased from high to significant. This is in recognition of an undeniable warming trend for the UK. Climate change has already influenced the likelihood of temperature extremes with the chances of seeing 40°C days in the UK as much as 10 times more likely in the current climate than in a climate unaffected by human influence.

However, the influence of weather doesn’t stop there, even incidents that aren’t caused by the weather

are often influenced by it and the government and resilience community often rely on the Met Office for information vital in protecting the public. For example our volcanic ash forecasts, at times of a volcanic eruption, support decision-making by airlines, the CAA and NATS keeping passengers safe and reducing transport disruption. Plumes of pollution from hazardous waste fires can be predicted, helping inform decisions about air quality and possible evacuations. Climate change is one of the most serious threats facing our world today and the Met Office is home to some of the world's foremost climate scientists, their research supports mitigation and adaption plans both here in the UK and across the globe.

Space weather has been on the NRR since 2011, when it was recognised as a potential threat by the UK Government. Its risk level is also being upgraded from high to significant in the latest NRR. Severe space weather events can have potentially devastating impacts on critical national infrastructure and these potential impacts are becoming even more of a risk as we become more and more reliant on technology such as radio communications, satellites, and Global Positioning Systems (GPS). Space weather prediction is of crucial importance to the likes of power companies, satellite operators and the aviation industry. The Met Office Space Weather Operations Centre is one of just a handful of 24/7 space weather prediction centres around the globe, monitoring activity on the surface of the sun.

Our Services Operations Centre in Exeter is a 24/7 facility that not only monitors weather but also hosts the joint Met Office / Environment Agency Flood Forecasting Centre that provides flood guidance for England and Wales and monitoring the risk of severe space weather events.

Every year impacts from severe weather cost the UK millions of pounds. It is estimated that insurance losses from Storm Eunice in February 2022 alone totalled £200-350 million. The human cost is often more significant – the same storm is reported to have caused 3 deaths in the UK with a further 14 fatalities across Europe. These human and economic impacts highlight the destructive power of such storms.

Pioneering work undertaken by Met Office scientists is giving us a better understanding of the changes we can expect to high impact weather events as a result of climate change. This work details the likely frequency and type of extreme weather events we can expect in the future, along with their likely impact. Whilst risk assessments and plans may be robust at the moment, evolution of these plans is necessary as climate change continues to affect the weather conditions of the UK. Extreme weather events are becoming more severe and more common. The heatwave of July 2022 is a perfect example of this with the UK reaching 40.3^{o}C in Lincolnshire. This smashed the previous UK record of 38.7^{o}C and temperatures of this level will likely be exceeded in coming years as the global climate warms.

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Signs of warmer weather on the way?

Description

With a mixture of sunshine and showers expected for many through this weekend, there are some tentative signals highlighting the possibility of some warmer weather developing later next week, but what can we say at this range?

Recent weather

The UK provisionally recorded its sixth wettest July on record, with a succession of low pressure systems bringing unseasonably wet and windy conditions. While August has started fairly unsettled for many, Thursday (10 August) provided a brief glimpse of warmer weather for many. The 28.4°C recorded at Wellesbourne on Thursday was the highest temperature recorded in the UK since 8 July. But will we see warmer weather again?

Looking further ahead

The forecast for the weekend and early next week at least is for unsettled conditions to be dominant, with a mixture of sunshine and showers for many, as well as some heavier periods of rain for some.

However, during the latter half of next week, signals are emerging for the possibility of warmer weather returning for at least parts of the UK, though the extent and longevity is still somewhat uncertain. There are also a range of other possible outcomes with lesser levels of likelihood.

Met Office Deputy Chief Meteorologist Rebekah Sherwin said: “While there’s an unsettled outlook for this weekend and the start of next week, our long-range models are starting to signal the possibility of some warmer, more settled, weather developing later next week.”

The Met Office uses ensemble forecasting to determine the likelihood of certain weather scenarios occurring. This means that the computer model is run a number of times from slightly different starting conditions to give an indication of the more likely or less likely scenarios.

Rebekah said: “What we’re seeing in our ensemble forecasts for later next week is a likelihood of some warmer weather developing, at least for parts of the UK. The most likely scenario is for high pressure to the east and low pressure to the west, which would allow a southerly flow to develop and draw warmer air from continental Europe over the UK.

“With this scenario, temperatures into the low 30s Celsius are possible in the southeast towards the end of next week or over the weekend. What’s less clear from our models is how far north this warmth may spread from the southeast, how long it will last and the exact dates that warmer weather might exert its influence.”

Although some milder conditions are looking likely in the current outlook, it is not a similar signal to that of the record-breaking temperatures the UK experienced last summer, with anything that does develop likely being a more typical UK summer warm period, especially in the southeast.

In order to be an official heatwave, any warm period would have to reach specific thresholds for three consecutive days. At present, it's unclear how long-lasting any warmer weather might be later next week and it could fall short of the heatwave threshold in any given place.

Warmth isn't the only possibility

Despite the signals for warmth to be likely later next week, there are still a small number of model runs that retain more unsettled weather for the UK.

Rebekah explained: "While some more settled and warm weather is the most likely scenario, at least for a few days, there are still a few outliers in our model runs that retain a more unsettled outlook for the UK weather. More certainty will develop in the coming days, as much depends on how these low and high-pressure systems interact."

Find the latest Met Office forecast on the Met Office website.

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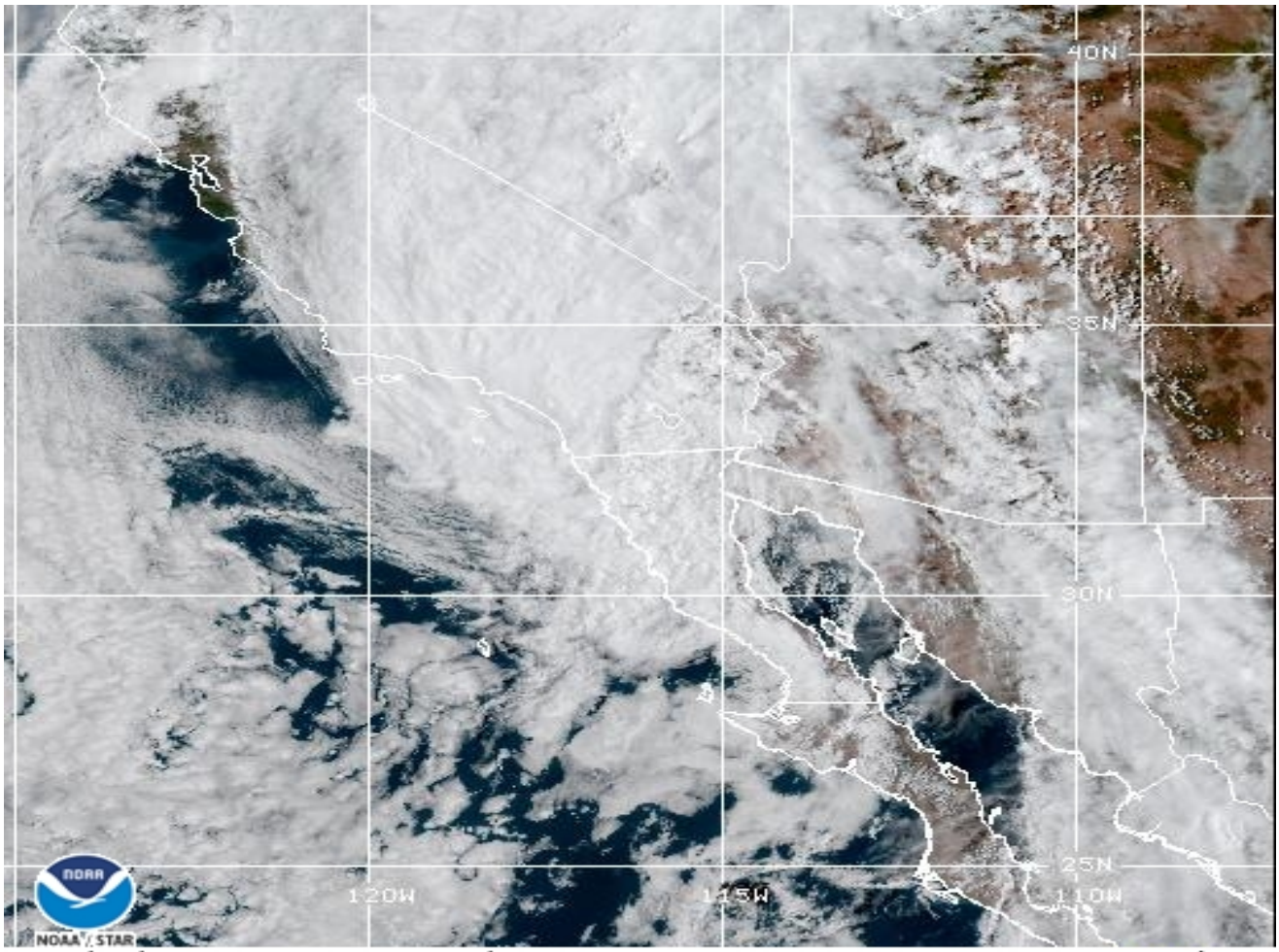
Hilary bringing a year’s worth of rain in a single day

Description

The Hollywood studios of southern California are renowned for creating dramatic storylines. But sometimes the region produces events which rival anything from a film producer’s imagination.

Tropical Storm Hilary – a former hurricane – is bringing intense rainfall to the South Western United States. So much rain is forecast that some locations in southern California and southern Nevada could see their average annual rainfall in a single 24-hour period.



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Hilary crossed the border in southern California earlier this morning. The system has weakened to a ‘post-tropical depression’ bringing continued heavy rainfall as it moves northwards inland across the state’s deserts and mountains. Hilary will continue into Nevada, Oregon, Idaho and Montana.

The expected threats affecting the region will include flash flooding, and rapidly rising rivers. In such a normally arid region landslides are an ongoing threat in some locations.

Rainfall accumulations

Dr Julian Heming is a Met Office expert on tropical cyclones. He said: “Although Hilary reached hurricane status, its greatest impacts now will be the heavy rainfall. Forecasters are expecting rainfall accumulations as high as 150-250mm for parts of the region and up to 75mm further north across the Western United States.

“The average August rainfall for the affected areas is generally less than 25mm. This creates the potential that some locations could see a year’s worth of rainfall in a single day.”

Looking at the outlook for the rest of the year and into 2024, forecasters are considering the influence of El Niño – a natural cycle of warming which occurs every few years in the eastern Tropical Pacific. Julian added: “El Niño, which is developing now, promotes more frequent and stronger hurricanes in the eastern Pacific. A significant proportion of storms moving this far north have been in El Niño years including ‘Nora’, the last one to reach California in 1997.”

Those with a longer memory will recall 1976 when ‘Kathleen’ took a similar track and produced severe flooding and widespread impacts across southern California.

Is there a link to climate change?

Climate modelling suggests that tropical cyclones could become more intense as a result of climate change. This is principally driven by warmer oceans as a result of climate change.

As the atmosphere warms, tropical cyclones will be able to hold more water, resulting in more intense rainfall events, which can be prolonged if a tropical cyclone stalls near the coast.

This research – led by Columbia University with support from Dr Malcolm Roberts from the Met Office – shows that the rapid-intensification of tropical cyclones is likely to increase in frequency.

The paper summarises that tropical cyclones are challenging features for climate models to resolve, so further research and review is still needed to fully understand the impact of climate change on tropical cyclones.

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How does weather and climate impact British Wildlife?

Description

This month's Met Office climate theme is how climate science can help decision makers plan in a future, warmer climate. As well as working closely across central government departments, we have recently partnered with The Wildlife Trusts (our corporate charity) to build better climate awareness into their decision making.

Groups of nature-enthusiastic Met Office volunteers are applying their expertise in a series of areas identified by The Wildlife Trusts as potential climate risk areas for British wildlife where they have struggled to access the right climate information.

These range from looking at how changing temperature and rainfall patterns are affecting barn owl nesting behaviours and sightings in Northern Ireland, right through to how warmer sea surface temperatures could lead to further explosions in the population of invasive Pacific oysters in Kent, competing native wildlife for space on the shoreline.

Other projects are identifying suitable Wildlife Trust (WT) sites for reintroduction of rare plant species in the future warmer climate, as well as identifying weather and climate indicators which can be used to optimise certain conservation activities, like hay-cutting periods or how vulnerable WT sites are to sea level rise. Ultimately this partnership hopes to help The Wildlife Trusts communicate what a future warmer climate might mean for wildlife.

Debbie Hemming, from the Met Office working on the science side of these projects, said: "The aim of these projects is to enable Met Office staff to volunteer their time and expertise to help The Wildlife Trusts support our wildlife now and in the future." Kathryn Brown, Director of Climate Change and Evidence at The Wildlife Trusts, said: "We're delighted to be The Met Office's corporate charity partner of the year and these projects, done solely with volunteer time from our Met Office colleagues, will be fantastic exemplars for showing how cutting edge data can be used to help make decisions on the ground now, to help us better conserve our precious wildlife across the UK."

The barn owl is one of the most distinctive countryside birds with a heart-shaped face and light feathers. Photo credit of the Ulster Wildlife.

Shoresearch surveys for the Pacific Oyster in Kent. Images courtesy of Kent Wildlife Trust.

Earlier this summer, Met Office Meteorologist and Presenter Clare Nasir spoke to Ali Morse, Water Policy Manager from The Wildlife Trusts about how the hottest June on record left some of our wildlife struggling in the heat (you can listen to the full interview on the Met Office Weather Snap podcast). podcast).

Plants that succumbed to the heat early in the year may have a shortened flowering season, reducing food for pollinators, and not producing fruit such as berries in the autumn, which is another vital food

source for small mammals and birds.

During June 2023, a large number of fish were found dead in the River Cam in Cambridge and fishery officers saved thousands of fish in distress in the South East, due to hot weather impacting the water environment including the concentration of oxygen in watercourses. The Environment Agency's response involved pumping air into rivers to restore dissolved oxygen levels.

Ali Morse, Water Policy Manager from the Wildlife Trust said: "What surprised me is that it's happening so early in the year… seeing it now is really quite unusual."

Climate change is expected to cause more intense downpours in summer which runs into rivers and can cause localised flooding downstream. One way The Wildlife Trusts are hoping to protect against flooding is by introducing more beavers across the UK.

Beavers build dams that hold water behind them, which spills over onto land and creates a miniature wetland: a fantastic habitat for species such as dragonflies, insects, fish and waterbirds. The re-introduction of beavers creating more wetland habitats acts as a sponge for heavy summer rainfall that can reduce flooding downstream, as well as topping up aquifers. Ali Morse added: "So one of the key ways that we can help to mitigate the effects of both flooding and droughts is to restore beavers to our landscape. And that's something that The Wildlife Trusts are really keen to see in the future."

As an organisation the Met Office is always looking for ways to make a positive difference to our environment and communities and these research projects are just one example of how we do this. Clare Frank, Met Office lead for the corporate charity partnership, said: "We are delighted to have been working with The Wildlife Trusts as our corporate charity for the past 10 months. Projects such as these really bring to life our corporate value to be a force for good. We are already seeing so many benefits from the partnership and I'm sure we will see more as these projects evolve."

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How will cold weather affect energy demand in a changing climate?

Description

This month we have been exploring the topic of climate science for decision making. The UK Government's Net Zero Strategy includes commitments related to how we decarbonise our energy supply and how we power buildings in light of our changing climate. In this blog post we explore the value of weather and climate science in achieving these commitments.

Air source heat pumps are widely tipped to be a significant part of the heating energy mix in future. Picture: Adobe Stock.

Reducing our reliance on fossil fuels to heat and power homes and buildings is critical as we strive to mitigate against the worst impacts of our changing climate. When choosing the most appropriate alternatives, there are many factors to consider such as cost, suitability for retrofitting and performance.

At the Met Office, we have been undertaking research to improve understanding of the impact of cold-weather events upon energy demand if heat pumps play a significant role in decarbonising heating.

The electrification of heating would significantly increase the sensitivity of energy demand to temperature, particularly during periods of cold weather where heating demand is high.

If heat pumps are installed widely, the overall electricity demand could reduce on cold days compared to a highly-electrified energy system without heat pumps. Recent performance data analysis indicates that air source heat pump performance has improved over the past seven years. However, their

efficiency decreases as external temperature decreases. So it is important to understand the impact of extreme cold weather events on electricity demand in a scenario with high heat pump installation.

Cold weather events

Using a sample area of central England, we have explored the daily minimum temperatures associated with cold-weather events of different return periods in current and future climates. The return period of an event is linked to its frequency, with an event with a return period of 20 years (a 1-in-20-year event) expected to occur once in that time. For example, we found that for this area and in today's climate, a cold-weather event with a daily minimum temperature of -10.5 °C is a 1-in-20-year event.

The temperature associated with extreme cold events in 2050 will depend on the level of global greenhouse gas emissions in coming years. In a low-emission scenario we could expect a 1-in-20-year event in 2050 to be associated with a minimum temperature of -8.4 °C.

Met Office scientist Isabel Rushby explains: "Our analysis provided updated temperature values to be used in modelling around heat pumps, including an expected 1-in-20-year cold-weather event in today's climate and in 2050, considering a range of emissions scenarios. We've also analysed hourly temperatures during these events to help answer questions about within-day temperature variability. This is important to consider as electricity demand can vary greatly depending on the time of day."

Energy demand and generation

Our next step will be to further characterise weather events that may place stress on the future energy system in terms of energy demand and generation, including how these weather events may look in the future with climate change. This will allow us to provide, for example, context around expected wind speeds and how this relates to renewable energy generation when a 1-in-20-year cold-weather event occurs.

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